

NP40N10YDF, NP40N10VDF, NP40N10PDF

R07DS0361EJ0100

Rev.1.00

Jun 07, 2011

MOS FIELD EFFECT TRANSISTOR

Description

These products are N-channel MOS Field Effect Transistors designed for high current switching applications.

Features

- Low on-state resistance
 - $R_{DS(on)} = 25 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$) (NP40N10YDF)
 - $R_{DS(on)} = 26 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$) (NP40N10VDF)
 - $R_{DS(on)} = 27 \text{ m}\Omega \text{ MAX.}$ ($V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$) (NP40N10PDF)
- Low C_{iss} : $C_{iss} = 2100 \text{ pF TYP.}$ ($V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$)
- Logic level drive type
- Designed for automotive application and AEC-Q101 qualified

Ordering Information

Part No.	Lead Plating	Packing		Package
NP40N10YDF-E1-AY ^{*1}	Pure Sn (Tin)	Tape 2500 p/reel	Taping (E1 type)	8-pin HSON
NP40N10YDF-E2-AY ^{*1}			Taping (E2 type)	
NP40N10VDF-E1-AY ^{*1}	Pure Sn (Tin)	Tape 2500 p/reel	Taping (E1 type)	TO-252 (MP-3ZP)
NP40N10VDF-E2-AY ^{*1}			Taping (E2 type)	
NP40N10PDF-E1-AY ^{*1}	Pure Sn (Tin)	Tape 800 p/reel	Taping (E1 type)	TO-263 (MP-25ZP)
NP40N10PDF-E2-AY ^{*1}			Taping (E2 type)	

Note: ^{*1}. Pb-free (This product does not contain Pb in the external electrode.)

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)

Item	Symbol	Ratings	Unit
Drain to Source Voltage ($V_{GS} = 0\text{ V}$)	V_{DSS}	100	V
Gate to Source Voltage ($V_{DS} = 0\text{ V}$)	V_{GSS}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 40	A
Drain Current (pulse) ^{*1}	$I_{D(pulse)}$	± 80	A
Total Power Dissipation ($T_C = 25^\circ\text{C}$)	P_{T1}	120	W
NP40N10YDF Total Power Dissipation ($T_A = 25^\circ\text{C}$) ^{*2}	P_{T2}	1.0	W
NP40N10VDF Total Power Dissipation ($T_A = 25^\circ\text{C}$) ^{*2}		1.2	
NP40N10PDF Total Power Dissipation ($T_A = 25^\circ\text{C}$)		1.8	
Channel Temperature	T_{ch}	175	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to $+175$	$^\circ\text{C}$
Single Avalanche Current ^{*3}	I_{AS}	25	A
Single Avalanche Energy ^{*3}	E_{AS}	61	mJ

Thermal Resistance

Channel to Case Thermal Resistance	$R_{th(ch-C)}$		1.25	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance ^{*2}	$R_{th(ch-A)}$	NP40N10YDF	150	$^\circ\text{C/W}$
		NP40N10VDF	125	$^\circ\text{C/W}$
		NP40N10PDF	83.3	$^\circ\text{C/W}$

Notes: ^{*1}. $T_C = 25^\circ\text{C}$, $PW \leq 10\text{ }\mu\text{s}$, Duty Cycle $\leq 1\%$

^{*2}. Mounted on glass epoxy substrate of 40 mm x 40 mm x 1.6 mm with 4% copper area (35 μm)

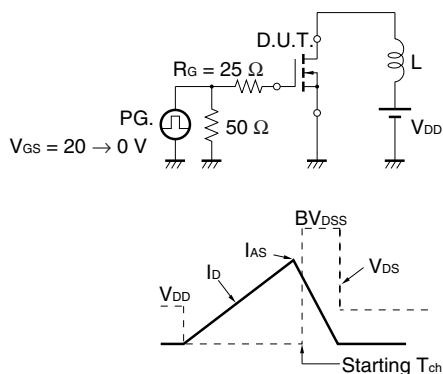
^{*3}. $T_{ch(start)} = 25^\circ\text{C}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, $L = 100\text{ }\mu\text{H}$, $V_{GS} = 20\text{ V} \rightarrow 0\text{ V}$

Electrical Characteristics ($T_A = 25^\circ\text{C}$)

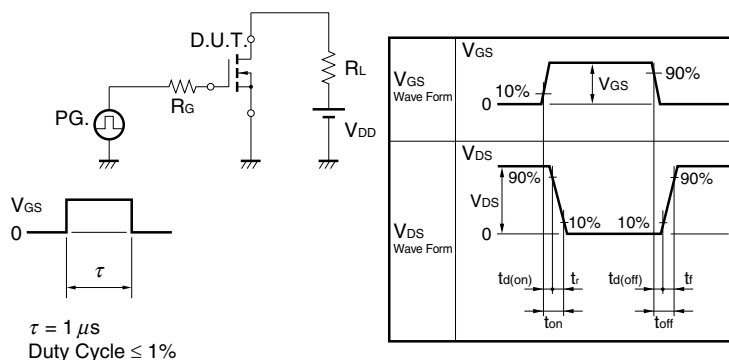
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Zero Gate Voltage Drain Current	I_{DSS}			1	μA	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	I_{GSS}			± 100	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	1.5	2.0	2.5	V	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$
Forward Transfer Admittance ^{*1}	$ y_{fs} $	20	40		S	$V_{DS} = 5.0\text{ V}, I_D = 20\text{ A}$
Drain to Source On-state Resistance ^{*1}	NP40N10YDF	$R_{DS(on)1}$	21	25	$\text{m}\Omega$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$
		$R_{DS(on)2}$	23	30	$\text{m}\Omega$	$V_{GS} = 5.0\text{ V}, I_D = 20\text{ A}$
		$R_{DS(on)3}$	24	36	$\text{m}\Omega$	$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$
	NP40N10VDF	$R_{DS(on)1}$	21	26	$\text{m}\Omega$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$
		$R_{DS(on)2}$	23	31	$\text{m}\Omega$	$V_{GS} = 5.0\text{ V}, I_D = 20\text{ A}$
		$R_{DS(on)3}$	24	37	$\text{m}\Omega$	$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$
	NP40N10PDF	$R_{DS(on)1}$	21	27	$\text{m}\Omega$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$
		$R_{DS(on)2}$	23	32	$\text{m}\Omega$	$V_{GS} = 5.0\text{ V}, I_D = 20\text{ A}$
		$R_{DS(on)3}$	24	38	$\text{m}\Omega$	$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$
Input Capacitance	C_{iss}		2100	3150	pF	$V_{DS} = 25\text{ V},$ $V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$
Output Capacitance	C_{oss}		200	300	pF	
Reverse Transfer Capacitance	C_{rss}		80	144	pF	
Turn-on Delay Time	$t_{d(on)}$		15	33	ns	$V_{DD} = 50\text{ V}, I_D = 20\text{ A},$ $V_{GS} = 10\text{ V},$ $R_G = 0\text{ }\Omega$
Rise Time	t_r		16	40	ns	
Turn-off Delay Time	$t_{d(off)}$		60	120	ns	
Fall Time	t_f		5	13	ns	
Total Gate Charge	Q_G		47	71	nC	$V_{DD} = 80\text{ V},$ $V_{GS} = 10\text{ V},$ $I_D = 40\text{ A}$
Gate to Source Charge	Q_{GS}		8		nC	
Gate to Drain Charge	Q_{GD}		12		nC	
Body Diode Forward Voltage ^{*1}	$V_{F(S-D)}$		0.9	1.5	V	$I_F = 40\text{ A}, V_{GS} = 0\text{ V}$
Reverse Recovery Time	t_{rr}		67		ns	$I_F = 40\text{ A}, V_{GS} = 0\text{ V},$ $di/dt = 100\text{ A}/\mu\text{s}$
Reverse Recovery Charge	Q_{rr}		162		nC	

Note: *1. Pulsed test

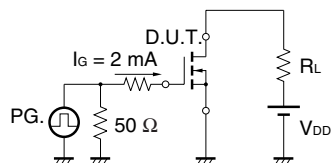
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

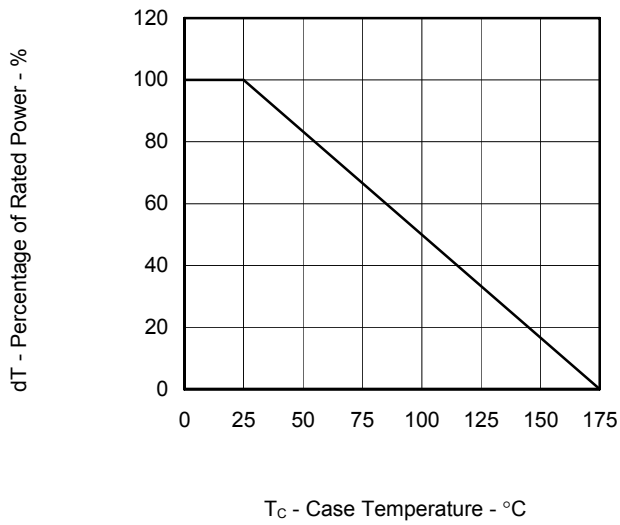


TEST CIRCUIT 3 GATE CHARGE

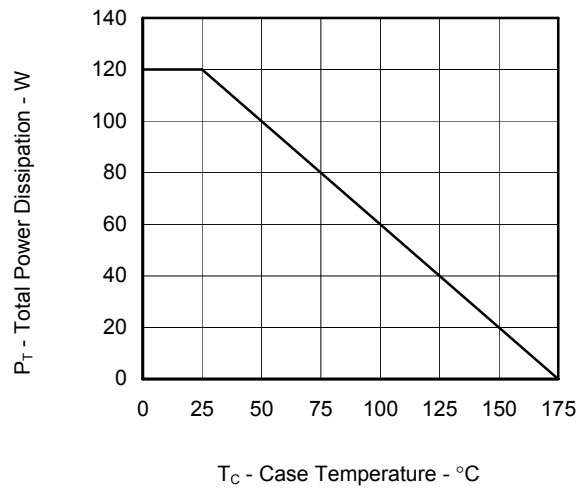


Typical Characteristics ($T_A = 25^\circ\text{C}$)

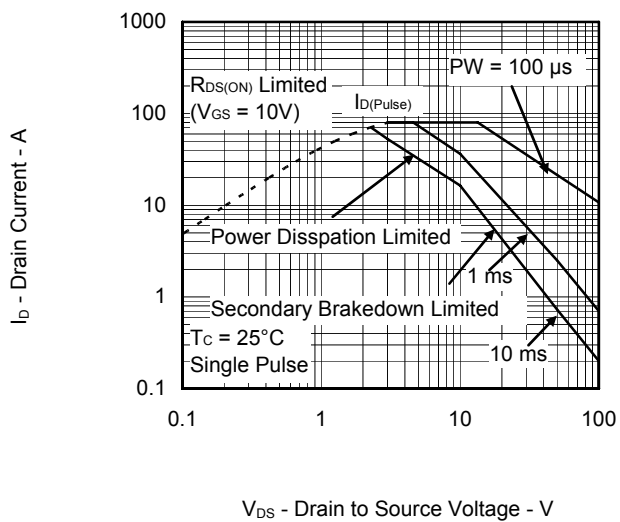
DERATING FACTOR OF FORWARD BIAS
SAFE OPERATING AREA



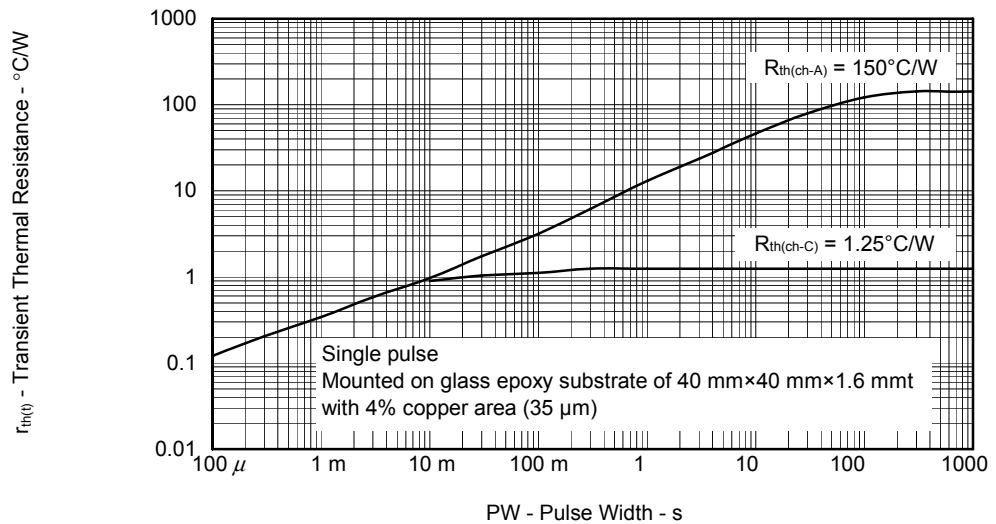
TOTAL POWER DISSIPATION vs.
CASE TEMPERATURE



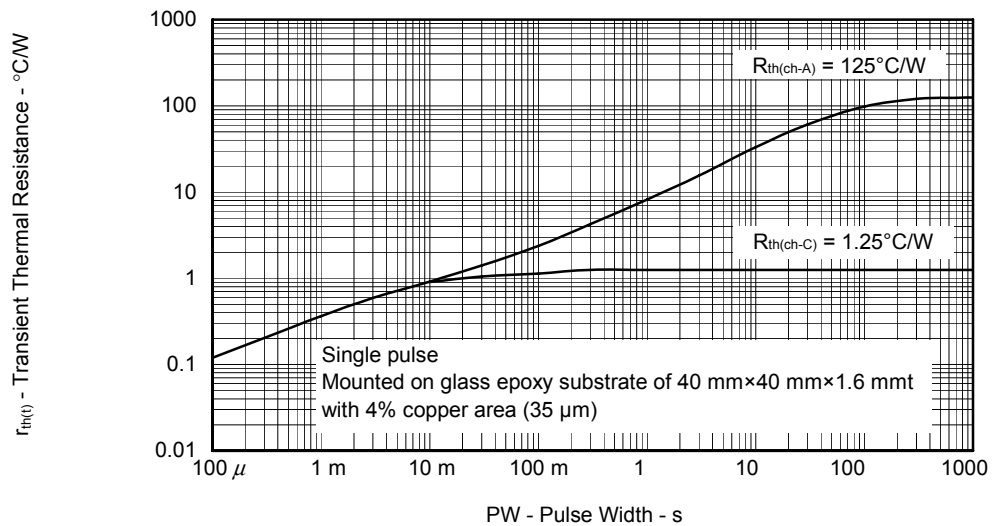
FORWARD BIAS SAFE OPERATING AREA



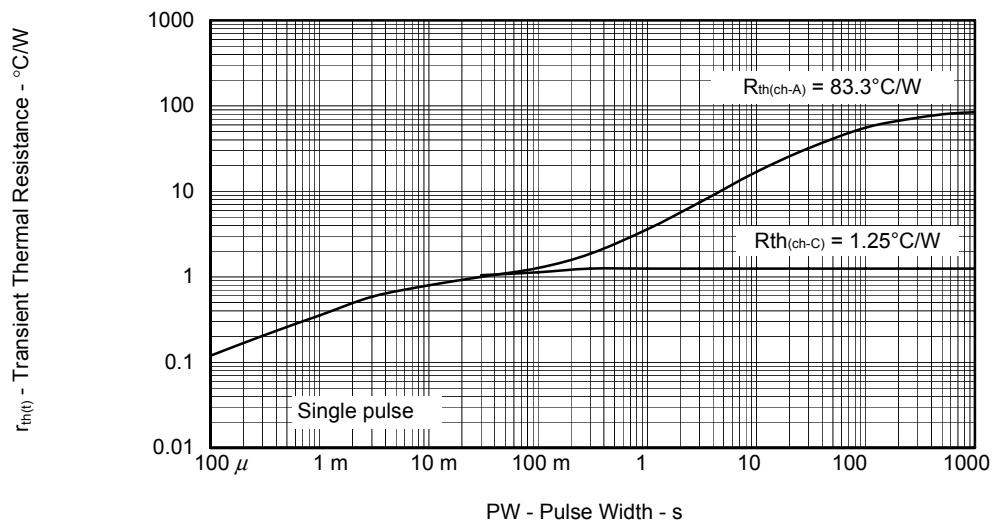
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10YDF)



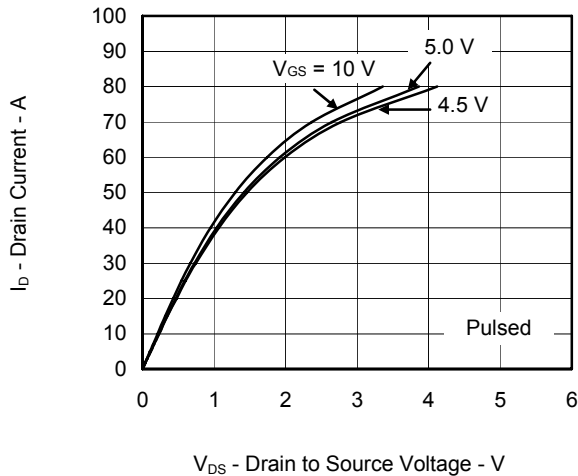
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10VDF)



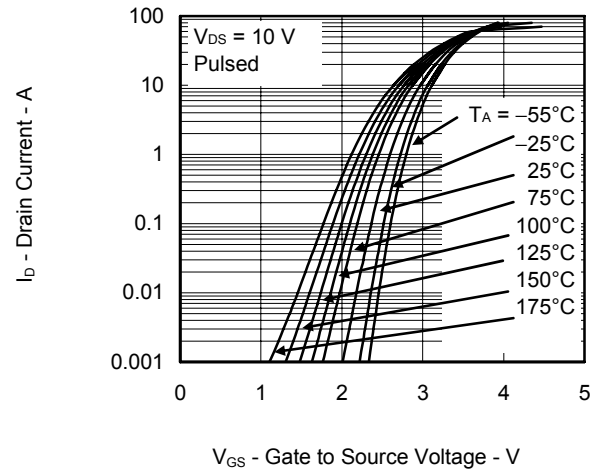
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH (NP40N10PDF)



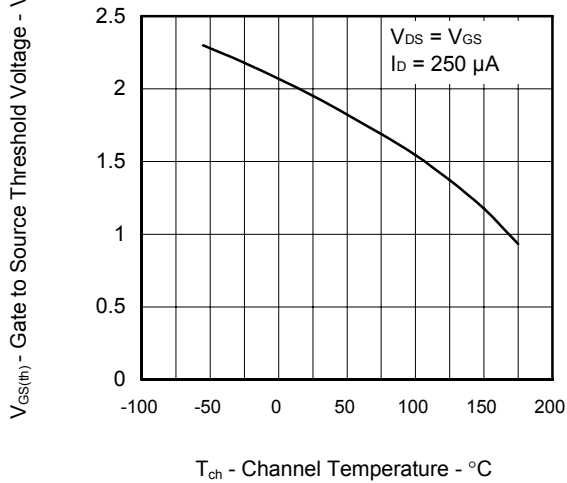
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



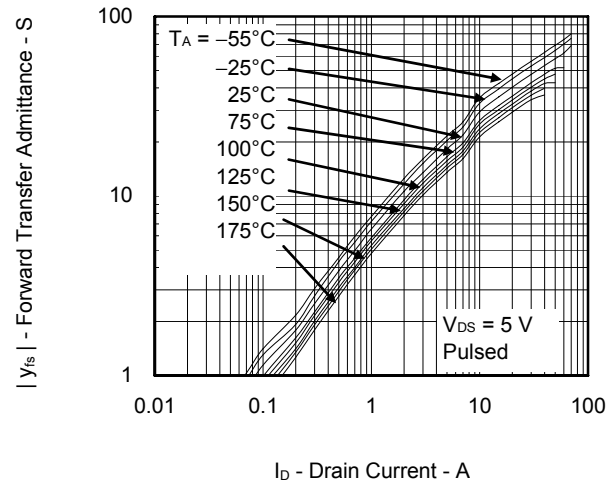
FORWARD TRANSFER CHARACTERISTICS



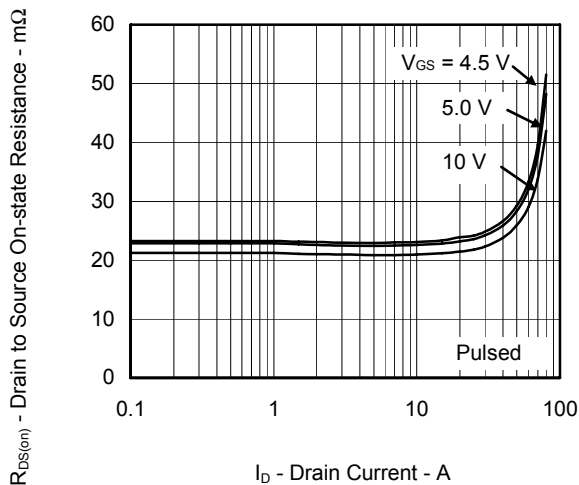
GATE TO SOURCE THRESHOLD VOLTAGE
vs. CHANNEL TEMPERATURE



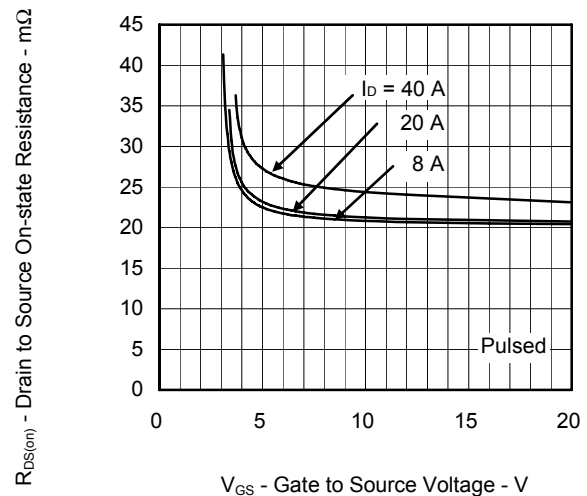
FORWARD TRANSFER ADMITTANCE vs. DRAIN
CURRENT



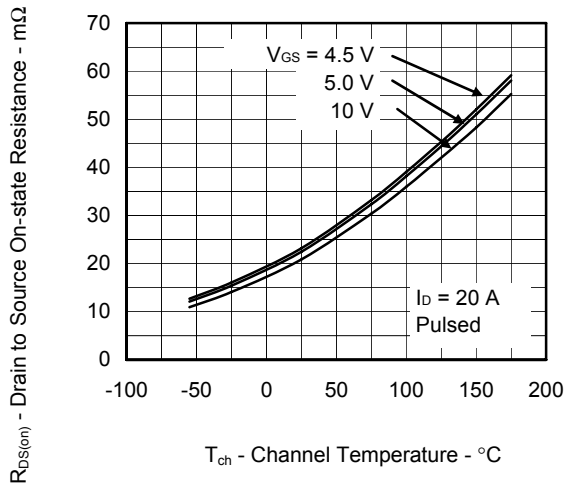
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



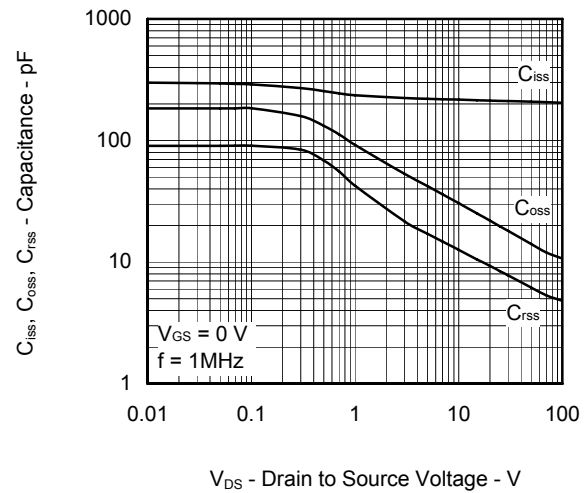
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



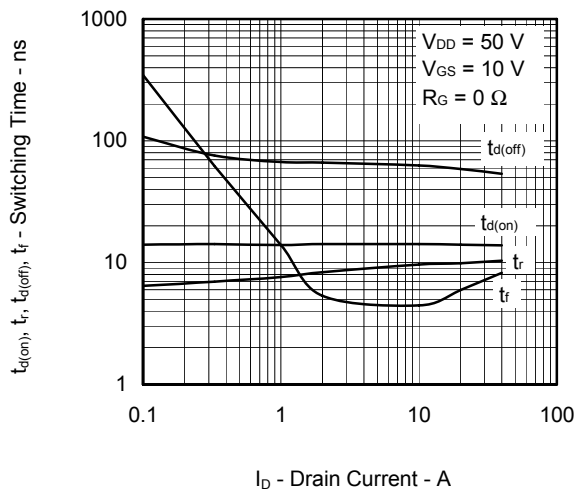
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



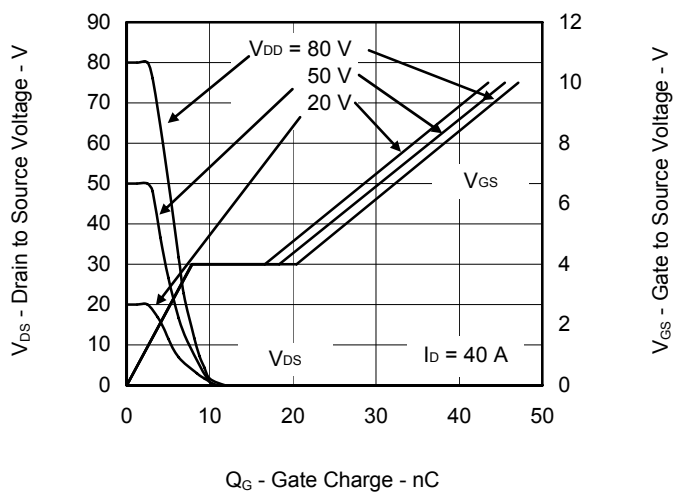
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



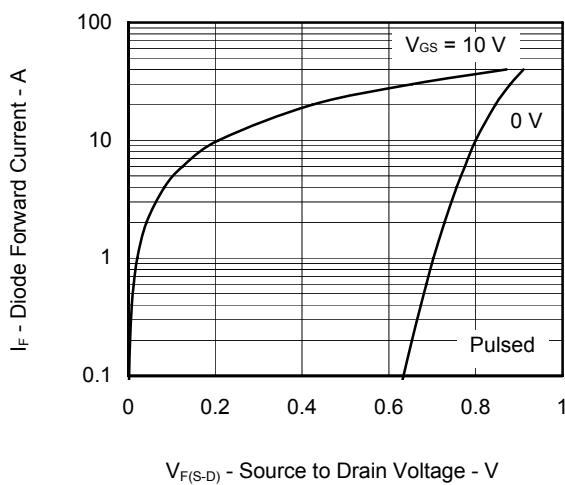
SWITCHING CHARACTERISTICS



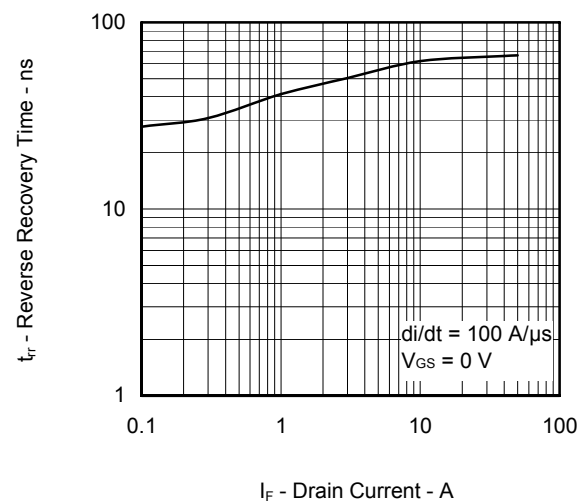
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

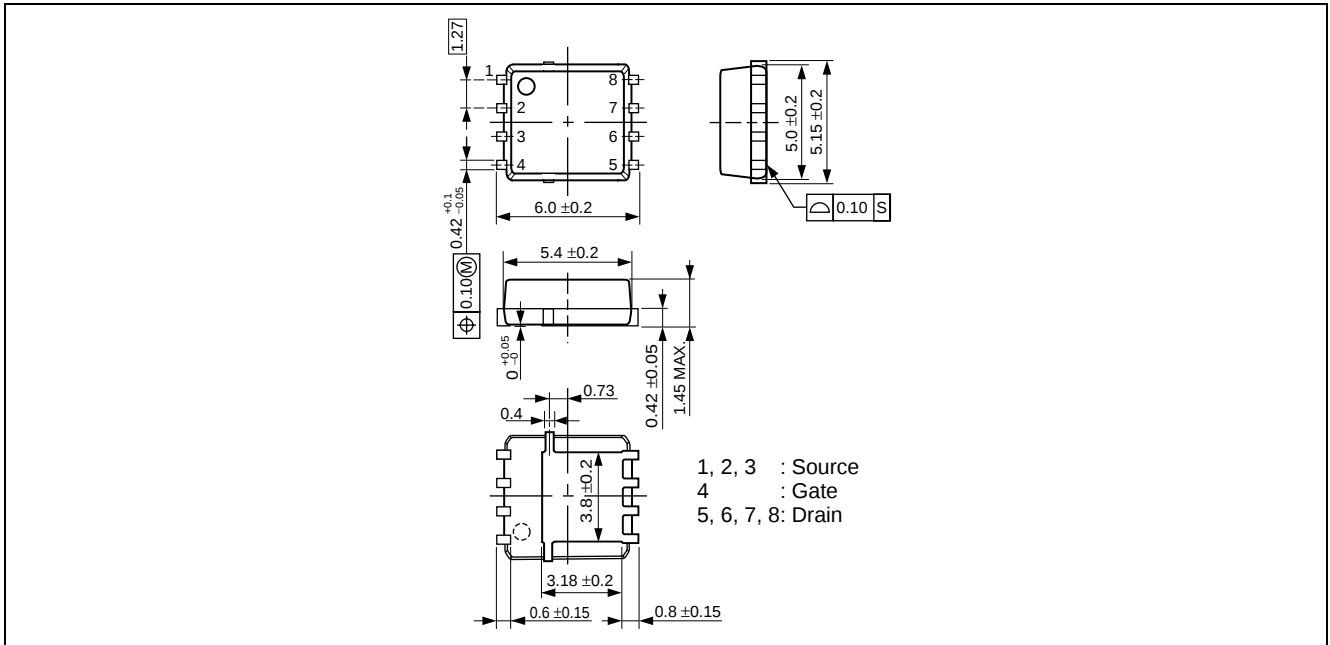


REVERSE RECOVERY TIME vs. DRAIN CURRENT

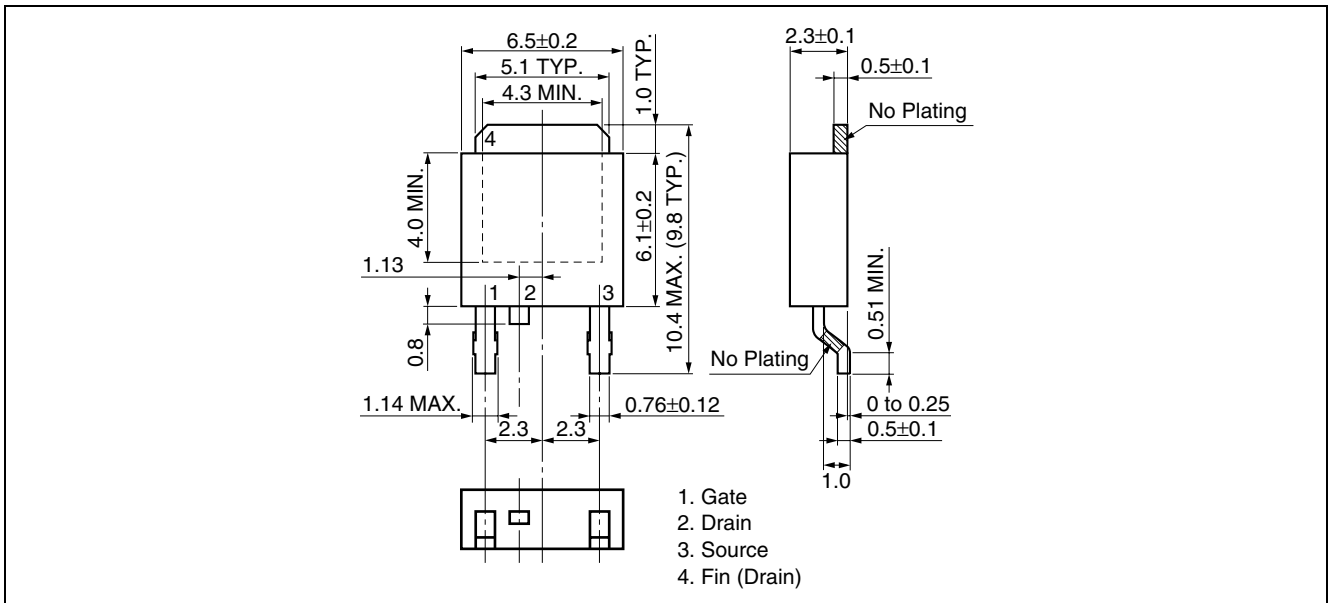


Package Drawings (Unit: mm)

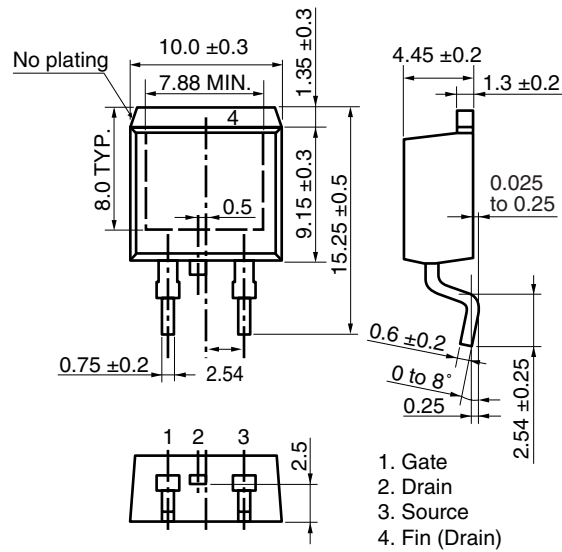
8-pin HSON (Mass: 0.13 g TYP.)



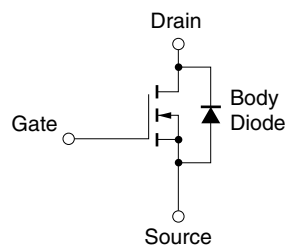
TO-252 (MP-3ZP) (Mass: 0.27 g TYP.)



TO-263 (MP-25ZP) (Mass: 1.48 g TYP.)



Equivalent Circuit



Remark Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

Revision History	NP40N10YDF, NP40N10VDF, NP40N10PDF Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Jun 07, 2011	—	First Edition Issued

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